Priming critical thinking: Simple interventions limit the influence of fake news about climate change on Facebook

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ABSTRACT

Fake news about climate change refers to fabricated information that mimics the appearance of legitimate reporting but is intended to mislead consumers. In light of concerns about fake news regarding climate change and other topics, researchers and media providers have been searching for ways to limit its spread and influence. This study tested the effect of two simple interventions, both of which primed critical thinking, on individuals' evaluation of the credibility of real and fake news about climate change on Facebook. Through an online experiment (n = 2,750 participants), participants either read a series of guidelines for evaluating news online, or read and then rated the importance of each guideline; a control group was not exposed to guidelines of any type. We found that participants exposed to both types of guidelines reported a reduced likelihood to trust, like, and share fake news about climate change on Facebook. Importantly, exposure to these guidelines did not diminish individuals' likelihood to trust, like, or share *legitimate* climate news. The effect sizes for both types of intervention were small. However, because of the scale and speed at which social media operates, even a small reduction in users' likelihood to trust, like, and share fake news could be meaningful and impactful.

Keywords: fake news, social media, climate change, Facebook, critical thinking

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1. INTRODUCTION

Since the period leading to and following the American election cycle of 2016, media outlets have warned that people in the U.S. are being exposed to "fake news". Fake news in this context refers to fabricated information intended to mislead consumers, which mimics the appearance of legitimate reporting (Lazer et al., 2018). A wide range of strategies can be utilized by fraudsters to create fake news; they include misrepresenting data or recommendations, presenting fabricated information, or sharing so-called insights or recommendations about a subject from people who lack the qualifications for offering them (Björnberg et al., 2017).

Though fake news has persisted for decades (Beiler and Kiesler, 2018), its reach and potentially deleterious influence has been exacerbated by its prevalence on a wide range of social media platforms, and by its purported role in influencing voters during the 2016 federal election (Allcott and Gentzkow, 2017; Grinberg et al., 2019; Guess et al., 2018). Recent research, for example, estimates that the average American adult viewed between one and three fake news stories on social media in the month leading to the 2016 election (Allcott and Gentzkow, 2017). And a separate study of Twitter users estimated that fake news accounted for approximately 6% of total news consumption on the site (Grinberg et al., 2019).

In light of concerns about fake news, researchers and media providers have been searching for ways to limit its spread and influence (Google News Initiative; Mosseri, 2017; Roozenbeek and van der Linden, 2019). Many websites now offer advice about how to detect fake news, or to evaluate the credibility of information online (Facebook Help Center; International Federation of Library Associations and Institutions, 2019; Kiely and Robertson, 2016; Smith; van der Linden, 2017). Facebook, in its online help center, offers advice for spotting fake news, including "be skeptical of headlines" and "investigate the source"; the public-facing Psychology Today offers similar advice. Despite the increasingly widespread availability of this kind of advice, its effects on consumers of information have not been thoroughly examined. Thus, our study sought to understand if exposure to these kinds of guidelines for evaluating the credibility of news could make people less likely to trust, engage with, and share fake news on social media.

The challenges associated with combatting fake news on social media are manifold. We know, for example, that social media sites are popular sources of news; 47% of Americans report that they use social media to check the news "sometimes" or "often", with Facebook being the most popular platform for this purpose (Shearer and Gottfried, 2017). We also know that social media providers typically do not police the accuracy or the sources of content posted to their platforms; and, because of how social media functions, information—be it true or false—can be shared or promoted quickly, easily, and repeatedly.

Social media's capability for speedy dissemination poses an especially acute challenge regarding false information because it tends to be shared or promoted more often than accurate information (Vosoughi et al., 2018).

Although fake news can cover any topic, our research focused on false information—in the form of posts from the Facebook newsfeed—about climate change. We did so because of the importance of climate change to global environmental, social, and economic affairs. Fake news about climate change typically states that climate change is not occurring, that it is not caused by humans, and that it does not pose a threat to humans and the environment (Farrell et al., 2019), thus perpetuating common and dangerous misconceptions.

To evaluate the effectiveness of guidelines in helping to limit the influence and spread of fake climate news, we asked participants to rate a post's trustworthiness *after* reviewing it. To mimic the choices Facebook users encounter on the platform, participants were also asked how likely they would be to "like" (which is a reflection of users' interest in content) and "share" (which leads to the proliferation of content among Facebook users) the post. Thus, trustworthiness, liking, and sharing represented the dependent variables in our research.

Prior research has offered complementary theories for why individuals may be susceptible to fake news. First, the messages imparted by fake news may align with deeply held political beliefs which, in turn, triggers identity protective cognition. People tend to be motivated to protect their beliefs from evidence to the contrary and may, therefore, align themselves with information that confirms what they already believe to be true or right (Kunda, 1990; Nir, 2011). For example, prior research suggests when people are the recipients of fake news that is in line with their preexisting beliefs or values, they will be less motivated to engage in critical reflection about its accuracy (Allcott and Gentzkow, 2017; Taber and Lodge, 2006). Secondly, recent research has suggested that a general lack of critical thinking—which may be independent of partisan motivation—is responsible for an individual's susceptibility to fake news. For example, controlling for political ideology, Pennycook and Rand (2018) found that individuals who scored highly on an assessment of analytical reasoning ability were better able to distinguish between fake and real news headlines.

In light of these perspectives, we were generally skeptical about the ability of mere exposure to guidelines to inoculate consumers against the effects of fake news; in our view at the outset, guidelines would not be powerful enough to overcome the partisan tug of motivated reasoning or the absence of critical thinking that may be common to consuming false information while scrolling through the Facebook News Feed while in cognitive autopilot. Thus, we hypothesized that people who simply read guidelines for spotting

fake news immediately before being exposed to inaccurate Facebook posts would be no less likely to trust, like, or share them when compared to a control group that did not receive the guidelines.

We did, however, speculate that encouraging people to more deeply process guidelines could prove powerful enough to subsequently influence their willingness to trust, like, and share fake news about climate change. Therefore, we tested a second intervention—which we labeled Enhanced Guidelines—where participants first received a series of guidelines and then were asked to rate the importance of each one in terms of helping to determine the credibility of news received on Facebook. In the same way that attribute weighting tools in research on decision support help people to make more internally consistent choices (Bessette et al., 2019; Gregory et al., 2016), we hypothesized that taking the time to rate individual guidelines would help people to consider them more deeply; this, in turn, would lead people to trust, like, and share fake news less when compared to a control group.

It is worth noting that a potential challenge associated with attempting to limit the influence and spread of fake news is a spillover effect whereby interventions aimed at false information would also limit the influence and spread of accurate information. Thus, in addition to studying the effect of guidelines and enhanced guidelines on fake news, we also tested them on real news about climate change.

2. METHODS

2.1 Design

Our study adopted a 3×2 experimental design involving two fake news interventions (Guidelines and Enhanced Guidelines) and a control (no intervention), and two types of news about climate change (fake and real). Participants were randomly assigned to just one of the six possible experimental variations, and their progression through the experimental design followed the same sequence of tasks.

Conditions. Participants in the control condition were informed that they would view a Facebook post about climate change, and then be asked to answer questions about what they saw.

In the Guidelines condition, participants were informed that they would view a Facebook post about climate change. Next, they were asked to consider a series of four questions (i.e., the guidelines) that would help them to evaluate the credibility of news online. The questions were: (1) *Do I recognize the news organization that posted the story?*; (2) *Does the information in the post seem believable?*; (3) *Is the post written in a style that I expect from a professional news organization?*; and (4) *Is the post politically motivated?* These guidelines reflected common recommendations for identifying fake news (Facebook

Help Center; International Federation of Library Associations and Institutions, 2019; Kiely and Robertson, 2016; Smith; van der Linden, 2017).

In the Enhanced Guidelines condition, participants were also informed that they would view a Facebook post about climate change, and they were also asked to consider the same four questions from the Guidelines condition. But, participants in this condition were also asked to rate the importance of each guideline (on a 1 – 10 scale from not at all important to very important) in terms of its ability to help them evaluate the credibility of news online.

Fake vs. Real News. In total, our study contained six Facebook news posts about climate change; three contained fake news and the other three contained real news (Figure 1). Participants were randomly assigned to view one of the six posts.

The three fake news posts were drawn from websites of three different hyper-partisan media outlets: Breitbart, InfoWars, and Natural News. Each of these outlets is known for peddling in conspiracy theories and disinformation, and content from each is heavily biased in favor of an ultra-conservative political ideology (Marwick & Lewis 2017). We utilized the search function on these three websites to identify posts containing false information about climate change. We confirmed that the Breitbart (*Now 400 scientific papers in 2017 say "global warming" is a myth*) and Natural News (*NASA confirms sea levels have been falling across the planet for two years…media silent*) posts contained falsehoods by cross-checking them with an independent fact-checking database (snopes.com). The post from InfoWars (*Al Gore insists global warming causes global cooling*) was confirmed as false by tracing the sources and information it cited; specifically, we located the blog post shared by Mr. Gore (from The Climate Reality Project) which explained that climate change may in some cases lead to colder weather, but not a cooler climate overall.

The three real news posts were drawn from NASA, USA Today, and Scientific American; these articles were selected because they reflect mainstream climate science, because they were published by reputable media outlets, and because they mirrored the themes in the opposing fake news posts: climate change is not a myth, sea levels are rising globally, and climate change may also lead to cold weather.

Facebook posts are accompanied by tags—which vary by post—including the number of "likes", the number of "shares", and a range of user-selected emojis that convey their emotional reactions to them. To control for their influence, we standardized the number of likes, number of shares, and types of emojis displayed for all six fake and real news posts (Figure 1). We also standardized the post date. Aside from

these edits, all of the text and the images in the posts were as they appeared in the original stories from the three fake news and three real news outlets.

2.2 Measures

After reviewing their randomly assigned post, participants were asked to rate its trustworthiness on a 10-point scale from 1 (not at all trustworthy) to 10 (very trustworthy). Participants also rated each post in terms of perceived accuracy on a 10-point scale from 1 (not at all accurate) to 10 (very accurate). Judged trustworthiness and accuracy were combined to create a single item index variable for trust (Cronbach's $\alpha = 0.93$). Participants were also asked to indicate their likelihood of "liking" or "sharing" their assigned post; these responses were collected on 11-point bipolar scales from -5 (definitely not) to 0 (neutral) to +5 (definitely yes). These scales were converted to continuous (1-11) scales for analysis.

In terms of covariates, participants were asked if they recognized the source of the Facebook post, choosing between binary (yes or no) response options. We hypothesized that climate doubters, who tend to be more politically conservative (Hornsey et al., 2016), would be more likely to trust fake news from sources recognized for having a conservative political ideology.

Next, we measured participants' domain-specific knowledge about climate change using an 11-item[1] scale used in previous research by us and others (Shi et al., 2015; Shi et al., 2016; Tobler et al., 2012). This scale included three subscales representing three different forms of knowledge: knowledge about the physics underlying climate change, knowledge about the reasons that climate change is happening, and knowledge about the different natural hazards and environmental effects of climate change. We hypothesized that participants who were more knowledgeable would be more discerning consumers—i.e., less likely to trust, like, and share—of fake news.

Because of increasing public concern and regulatory scrutiny regarding Facebook's role in the spread of disinformation as well as the company's handling of consumer data and privacy issues, we also asked participants to rate their current attitudes toward the platform; responses were collected on an 11-point bipolar scale from -5 (strong negative feelings) to 0 (neutral) to +5 (strong positive feelings). We speculated that a more positive attitude toward Facebook would lead people to view all posts as more trustworthy regardless of whether they contained real or fake news.

[1] The twelfth item typically included in the scale ("CO_2 is harmful to plants.") was unintentionally omitted from the physical knowledge subscale.

Finally, we collected demographic information from participants regarding their gender, age, education level, and political orientation (measured on a 5-point continuous scale from very conservative to moderate to very liberal).

2.3 Participants

Data collection took place in September 2018 using an online Qualtrics panel. The instrument was sent to adults over the age of 18 in the United States. Quota sampling was used to balance gender and belief in anthropogenic climate change; 50% of recruited participants believed climate change is human-caused (labeled "believers"), and 50% did not or were unsure (labeled "doubters").

Initially 4,212 participants responded to our instrument, of which 370 were removed because they did not complete the study. An additional 1,015 participants were removed from the sample because they failed an attention check (a multiple choice question which instructed participants to select a particular answer; n = 998 deleted) or because they selected the same response for every question in a 12-item scale (which was not part of this study; n = 17 deleted). Other participants were removed because they completed the experiment in less than half the median time (n = 69 deleted) or because they provided gibberish responses to a series of open-ended questions (which were not part of this study; n = 8 deleted). This left us with a final sample of 2,750 participants[2] (Table 1).

3. RESULTS

With respect to the relationship between our dependent variables, trust in a Facebook post was relatively strongly correlated with the intention to like it (Cronbach's $\alpha = 0.67$) and to share it (Cronbach's $\alpha = 0.59$); the correlation between the intention to like and share a post was even higher (Cronbach's $\alpha = 0.82$).

Table 2 presents mean ratings for our dependent variables by condition for both post types: fake and real news. We collapsed the three individual fake news (Figure 1: A, B, and C) and real news (Figure 1: D, E, and F) items for each post type.

A two-way ANOVA detected a significant main effect of post type ($F_{1, 2744} = 710.8$, $p < 0.001$), and a significant interaction between post type and condition ($F_{2, 2744} = 4.53$, $p = 0.011$) for trust. Here, the effect of condition on trust depended upon whether participants received real or fake news. We also detected a significant main effect of post type ($F_{1, 2744} = 275.4$, $p < 0.001$) on "liking"; for this variable, the interaction between post type and condition approached, but ultimately was not significant ($F_{2, 2744} =$

[2] Data will be made available in a data repository.

2.7, p = 0.066). For "sharing", the ANOVA detected a significant main effect of post type ($F_{1, 2744}$ = 171.9, p < 0.001), a significant main effect of condition ($F_{2, 2744}$ = 3.1, p = 0.047), and a significant interaction between post type and condition ($F_{2, 2744}$ = 4.53, p = 0.011); thus, participants' likelihood of sharing a Facebook post was influenced by both condition and post type. Overall, participants reported significantly lower ratings for trust, liking, and sharing when confronted with posts based on fake news as compared to real news, and, being exposed to Guidelines or Enhanced Guidelines had a downward effect on trust and "sharing".

Next, we used multiple linear regressions to more thoroughly study the effect of condition on the dependent measures when controlling for our covariates. We conducted 12 regressions, predicting each of our three dependent measures separately for doubters and believers who saw fake or real news.

3.1 Fake News

Linear regression analyses for the posts based on fake news (Table 3) indicated that climate change doubters exposed to the Guidelines condition were less likely to trust (η^2p = 0.011) and like (η^2p = 0.009) these posts. Doubters in Enhanced Guidelines condition were less likely to like (η^2p = 0.012) and share (η^2p = 0.006) fake news when compared to doubters in the control condition. Climate change believers exposed to the Guidelines condition were, by contrast, less likely to share (η^2p = 0.009) posts based on fake news, while exposure to the Enhanced Guidelines condition led believers to be less likely to trust (η^2p = 0.008) *and* share (η^2p = 0.019) fake climate news.

When controlling for the other covariates, participants' ability to recognize the sources of posts based on fake news also influenced their responses to the dependent measures (Table 3). Specifically, participants who were climate change doubters and who recognized either Breitbart or Natural News as sources of a fake news post were more likely to trust, like, and share the posts. Climate change believers were more likely to trust, like, and share a fake news post if they recognized Natural News as the source.

Beyond recognizing the source, and when controlling for other covariates, higher levels of domain-specific knowledge about climate change (Table 3) led believers to report lower levels of trust, and a lower likelihood of liking and sharing fake news. Higher levels of domain-specific knowledge had no significant effect on trusting, liking, and sharing amongst climate change doubters.

For both doubters and believers, the more positive a participant's attitude toward Facebook (Table 3), the more likely they were to trust, like, and share a post based on fake news. And, in terms of political orientation, doubters who self-identified as being more conservative were more likely to like and share

posts based on fake news; similarly, believers who self-identified as being more conservative reported higher levels of trust in, and were more likely to like and share, fake news posts (Table 3).

3.2 Real News

Linear regression analyses for the posts based on real news (Table 4) revealed that, when controlling for other covariates, believers of climate change who were exposed to the Guidelines condition were more likely to trust ($\eta^2p = 0.017$) real climate news. Exposure to the Guidelines or Enhanced Guidelines conditions had no effect on doubters of climate change.

Participants' ability to recognize the sources of posts once again influenced their responses to the dependent measures (Table 4). For both doubters and believers, recognizing the source of a post based on real news was associated with higher levels of trust, and a greater likelihood of liking and sharing the post almost half of the time.

When controlling for other covariates, higher levels of domain-specific knowledge about climate change (Table 4) led doubters to report greater trust in, and a higher likelihood of liking and sharing real news. For believers, higher scores on the scale measuring domain-specific knowledge led to higher levels of trust in posts based on real climate news.

As was the case with fake news posts, the more positive a doubter's or believer's attitude toward Facebook (Table 4), the more likely they were to trust, like, and share posts based on real news. And, in terms of political orientation, doubters and believers who self-reported higher levels of alignment with a conservative ideology were less likely to trust and like real climate news.

4. DISCUSSION

This study tested the effect of reading or interacting with guidelines for evaluating the credibility of Facebook news posts on individuals' likelihood to trust, like, and share fake and real news about climate change. It is noteworthy that we detected relatively high correlations between these three dependent variables. These relationships make sense in that trusting content on social media would be positively associated with liking it and sharing it; the even higher correlations between liking and sharing also make sense in that both are a form of online expression, and in most cases, represent approval of, or praise for, content.

With respect to our independent variable, participants in the Guidelines condition simply read suggestions for detecting fake news while those in the Enhanced Guidelines condition read the same guidelines but rated each one in terms of its importance for detecting fake news. A control group was not exposed to

guidelines of any sort. Participants were then asked to evaluate either a fake or real Facebook news post about climate change. We hypothesized that simply reading guidelines would not be a powerful enough intervention to influence a person's likelihood to trust, like, and share news online. However, we did anticipate that the additional rating task in the Enhanced Guidelines condition would help participants think more carefully about guidelines and, in turn, lead them to trust, like, and share fake news to a lesser extent relative to a control. We also predicted that these interventions would *not* negatively impact real climate news.

In line with our hypotheses, participants who saw enhanced guidelines were significantly less likely to trust, like, or share fake climate news. Contrary to our hypothesis, participants who only read simple guidelines were also less likely to trust, like, or share fake news. Both conditions had consistently small effect sizes for each dependent variable. Importantly, these interventions did not lower a participant's trust, like, and share ratings for real climate news.

Prior research has shown that people with higher analytical thinking abilities are better able to recognize fake news. Pennycook and Rand (2018), for example, show that individuals—independent of political ideology—who score highly on a modified version of the Cognitive Reflection Test (CRT; see Frederick, 2005) as well as a non-numeric version of the CRT (Thomson and Oppenheimer, 2016) were better able to distinguish between fake and real news headlines. Furthermore, Bronstein et al. (2019) also used the same two sets of CRT questions to measure the association between analytical thinking and assessment of fake news, and found that higher analytical reasoning scores were positively correlated with the ability to discern between real and fake news.

Our results seem to support these findings in that critical thinking may indeed play an important role in the evaluation of fake news. However, while prior research studied critical thinking ability as a covariate, our research is novel for treating it as a treatment effect. In other words, our research did not focus on preexisting ability, but instead relied upon simple interventions to prime critical thinking on the part of participants. The effectiveness of these primes is further supported by the observation that, when we control for education level and domain-specific knowledge about climate change, participants exposed to the Guidelines or Enhanced Guidelines treatment were still less likely to trust, like, and share fake news about climate change (Table 3).

In addition to critical thinking, our results suggest that motivated reasoning also contributes to a person's evaluation of fake news. We know that, when confronted with information that is inconsistent with deeply held beliefs or ideological viewpoints, people are often motivated to reject it in favor of information that is more closely aligned with their preexisting beliefs (Taber and Lodge 2006). Along these lines, our

results show that the more politically conservative a participant was, the more likely they were to trust fake climate news and mistrust real climate news. But, despite the powerful effect of motivated reasoning, our interventions led doubters of climate change to trust, like, and share fake climate news to a lesser degree.

Independent of our interventions, our covariates point to other factors (knowledge of climate change and attitudes toward Facebook) that also influenced a person's likelihood to trust, like, and share fake climate news. For example, it is noteworthy that climate change believers with higher levels of domain-specific knowledge about climate change were even less likely to trust, like, and share fake climate news when compared to climate change believers with lower levels of domain-specific knowledge. And, climate change doubters with greater domain-specific knowledge were more likely to trust, like, and share *real* climate news (compared to other climate doubters). Although there are many recent examples where objective facts related to politicized issues are discounted or ignored (Beck, 2017)—even amongst those that do not believe in, or who are unsure about, anthropogenic climate change—a high-level understanding of relevant facts can be influential even when these facts conflict with a person's prior beliefs. These results point to the critical importance of continuing to educate the public about climate change.

In addition, a positive disposition toward Facebook—regardless of whether a participant was a doubter of or believer in climate change, or whether they were exposed to real or fake news—had a significant, positive, and consistent effect on trusting, liking, and sharing content. This observation highlights an important challenge when it comes to preventing the spread of fake news on social media; that is, users who are positively disposed toward a social media platform may not be as critical of information they encounter on the site. Since Facebook (as well as other social media platforms like Twitter) does not moderate posts for accuracy, critical evaluation of posts is essential for consumers wishing to make more accurate judgments about the credibility of news online[3]. Thus, the mechanism behind the association between a positive disposition toward Facebook and a potential reduction in critical thinking warrants additional research. For now, these results suggest that simple—and, possibly, more elaborate—interventions will likely be less effective for users who are extremely fond of their chosen social media platform.

4.1 Limitations

[3] At the same time, an even more effective step would be the enactment of legislation that *requires* social media platforms that double as news sites to factcheck and moderate posts for accuracy.

Our results, while statistically significant, were associated with small effect sizes. For example, we observed a partial eta-squared (ηp^2) that was between 0.006 to 0.019 for each effect of our interventions on a participant's likelihood to trust, like, or share climate news on Facebook. However, the fact that Facebook sees over 1.5 billion active users per day, coupled with the small political margins that seem to be increasingly pervasive in American politics (Smidt, 2017)—e.g., the approximately 107,000 votes required in 2016 to tip the electoral college in favor of the sitting U.S. president accounted for only 0.0008% of the total number of ballots cast—we would argue that these small effects are still practically meaningful. For similar reasons, interventions that influence only a small fraction of social media users may nevertheless be important and impactful given the exponential rate at which information can be shared on social media. Since false information can quickly go "viral", preventing even a small number of people from sharing fake news has the potential to prevent an exponentially larger number of others from seeing and sharing the same content (Dow et al., 2013).

The composition of our sample may also be a limitation of our study in that it may not accurately reflect those who are most likely to spread fake news. For example, prior research (Guess et al., 2019) found that adults over the age of 65 are more likely to share fake news when compared to younger internet users. Although our research included 313 participants over the age of 65, we did not detect an association between age and trusting, liking, or sharing fake news. Future research on interventions designed to stem the spread of fake news may benefit from oversampling older adults.

Other limitations of our research are related to our study's design. Specifically, the window of time between exposure to our interventions and exposure to fake (and real) news was short, and our intervention was only tested on one post per participant. Thus, we should not assume that priming critical thinking *once* would be effective in light of repeated exposure to fake news. We believe that our understanding of interventions aimed at preventing the proliferation and influence of fake news would be enhanced by future research that adopts a longitudinal design, offers more than one opportunity for critical thinking, and presents participants with multiple news stimuli.

Likewise, our study utilized short fake news posts, which we selected to mimic the rapid-fire nature of viewing the Facebook News Feed. Future research should focus on the effectiveness of interventions for helping people to detect disinformation in longer and more detailed fake news stories. And, since fake news is a problem that transcends the topic of climate change, future research should also focus on the generalizability of interventions that target fake news across a wide range of socially, economically, and environmentally important subjects.

4.2 Conclusion

This study highlights the potential of simple interventions that prime critical thinking and slow the spread of fake news about climate change on social media platforms. However, several challenges—e.g., motivated reasoning, a strongly conservative political ideology, and low levels of domain-specific knowledge about climate change—continue to stand in the way of interventions designed to address the problem. Thus, a multiplex of approaches (rolled out in collaboration with social media providers) will be necessary to effectively combat the problems posed to society by fake news; chief among them are efforts to both improve the critical thinking abilities of people who rely on social media for their news and educate people about climate change.

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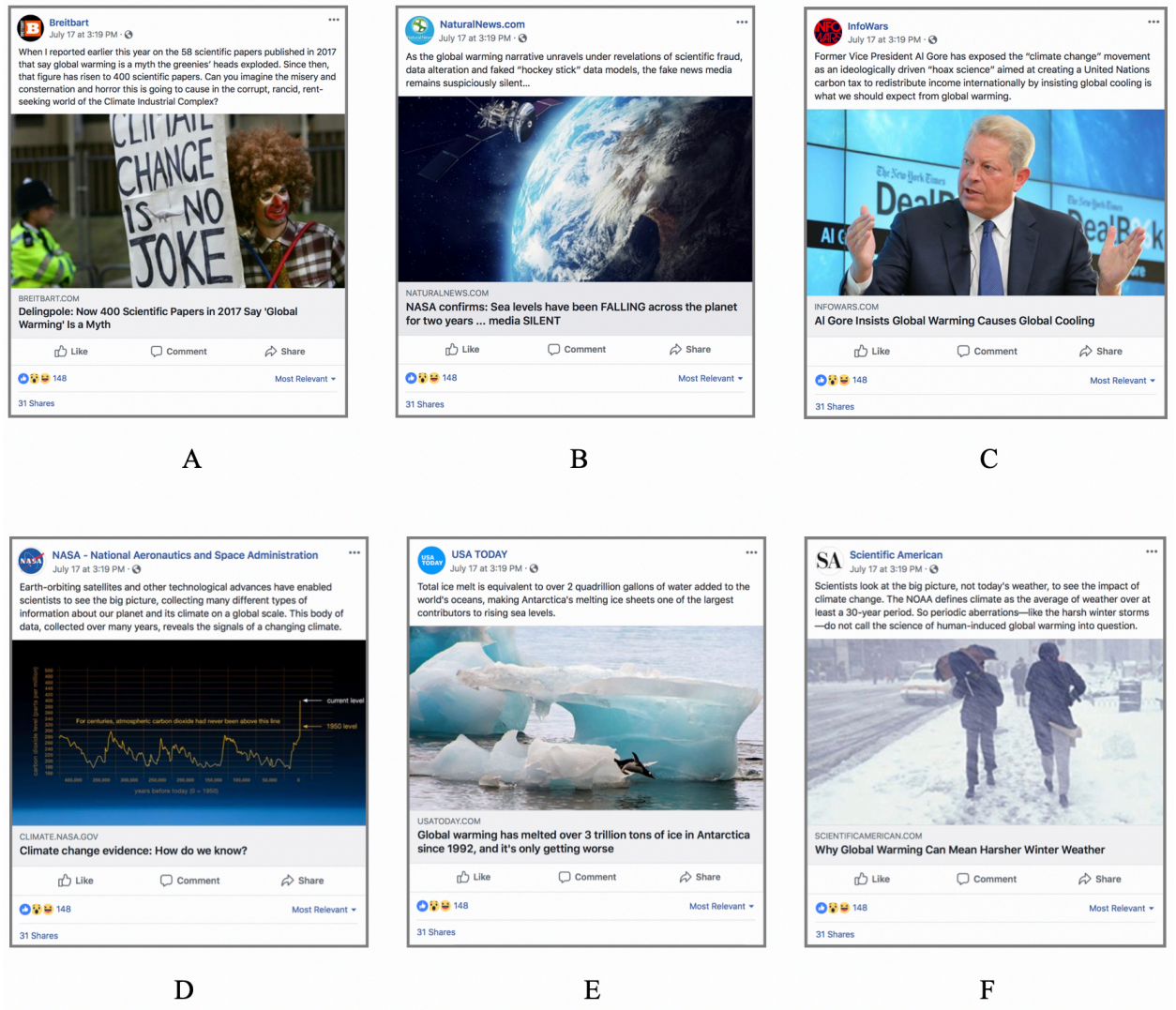

Figure 1. The fake news (A, B, and C) and real news (D, E, and F) posts used in this experiment.

	n	$\bar{x}_{Age}$	Percent Women	Percent College*	Percent Skeptic**
Fake News	1,397	44.40 (sd = 15.26)	50%	43%	50%
Breitbart	462	43.29 (sd = 14.72)	49%	41%	49%
Control	154	43.41 (sd = 15.12)	53%	35%	51%
Guidelines	159	42.57 (sd = 14.33)	45%	44%	47%
Enhanced	149	43.95 (sd = 14.77)	48%	45%	49%
Info Wars	458	45.32 (sd = 15.87)	50%	45%	49%
Control	165	45.22 (sd = 15.87)	51%	49%	52%
Guidelines	151	44.66 (sd = 15.82)	50%	41%	50%
Enhanced	142	46.13 (sd = 15.99)	49%	44%	44%
Natural News	477	44.58 (sd = 15.16)	51%	44%	51%
Control	158	44.34 (sd = 15.06)	53%	40%	52%
Guidelines	154	43.85 (sd = 15.38)	49%	48%	50%
Enhanced	165	45.48 (sd = 15.10)	50%	43%	50%
Real News	1,353	43.81 (sd = 14.93)	50%	45%	50%
NASA	452	43.75 (sd = 15.27)	48%	47%	48%
Control	151	43.47 (sd = 15.48)	50%	49%	48%
Guidelines	146	44.51 (sd = 15.50)	50%	42%	49%
Enhanced	155	43.30 (sd = 14.90)	44%	49%	48%
Scientific American	437	44.11 (sd = 14.66)	51%	45%	52%
Control	145	44.37 (sd = 14.64)	50%	46%	50%
Guidelines	143	43.66 (sd = 14.62)	51%	40%	52%
Enhanced	149	44.30 (sd = 14.81)	52%	48%	53%
USA Today	464	43.58 (sd = 14.86)	52%	44%	51%
Control	161	41.16 (sd = 14.64)	54%	39%	50%
Guidelines	164	44.71 (sd = 14.49)	54%	46%	51%
Enhanced	139	45.04 (sd = 15.31)	47%	47%	53%
Total Sample	2,750	44.11 (sd = 15.10)	50%	44%	50%

*Reflects percentage of participants who completed a degree in higher education (associates, bachelor, or graduate degree).
**Reflects percentage of participants who did not believe in anthropogenic climate change, or who were unsure.

Table 1. Sample Characteristics

	TRUST		LIKE		SHARE	
Fake News	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
All Conditions Collapsed	**4.08**	**2.53**	**4.23**	**3.21**	**4.10**	**3.21**
Control	4.28	2.55	4.55	3.25	4.51	3.32
Guidelines	3.93	2.60	4.12	3.27	4.00	3.24
Enhanced Guidelines	4.03	2.44	4.00	3.09	3.80	3.03
Real News						
All Conditions Collapsed	**6.56**	**2.34**	**6.24**	**3.16**	**5.69**	**3.19**
Control	6.38	2.34	6.17	3.23	5.65	3.20
Guidelines	6.69	2.40	6.32	3.17	5.78	3.15
Enhanced Guidelines	6.60	2.27	6.22	3.09	5.65	3.21

Table 2. Mean ratings of perceived trustworthiness, likelihood of "liking,", and likelihood of "sharing" across post type (fake news and real news).

FAKE NEWS	DOUBTERS						BELIEVERS					
	TRUST		LIKE		SHARE		TRUST		LIKE		SHARE	
	B	Std. Err.	*B*	Std. Err.	*B*	Std. Err.	*B*	Std. Err.	*B*	Std. Err.	*B*	Std. Err.
Intercept (Control, Breitbart)	3.64 ***	0.52	4.94 ***	0.67	4.05 ***	0.67	4.61 ***	0.57	4.60 ***	0.69	4.37 ***	0.70
Guidelines	-0.55 **	0.21	-0.66 *	0.27	-0.44	0.27	-0.31	0.22	-0.36	0.27	-0.70 *	0.28
Enhanced Guidelines	-0.11	0.21	-0.78 **	0.27	-0.55 *	0.27	-0.53 *	0.22	-0.51	0.27	-1.03 ***	0.28
Natural News	0.13	0.24	0.14	0.31	0.16	0.32	0.42	0.28	0.96 **	0.33	0.73 *	0.34
InfoWars	-0.21	0.27	-0.61	0.35	-0.66	0.35	-0.14	0.31	-0.02	0.37	-0.30	0.38
Recognize Source (Breitbart)	2.21 ***	0.32	2.48 ***	0.41	2.15 ***	0.41	0.18	0.33	0.22	0.39	0.14	0.40
Recognize Source (Natural News)	1.11 **	0.39	1.87 ***	0.50	1.18 *	0.51	1.41 ***	0.37	1.61 ***	0.45	1.80 ***	0.46
Recognize Source (InfoWars)	0.20	0.30	0.42	0.39	1.00 *	0.40	0.08	0.32	0.03	0.39	0.33	0.40
Knowledge of Climate Change	-0.01	0.04	0.01	0.05	0.02	0.05	-0.24 ***	0.04	-0.21 ***	0.05	-0.14 **	0.05
Positive Feelings Toward Facebook[†]	0.14 ***	0.04	0.24 ***	0.05	0.25 ***	0.05	0.24 ***	0.04	0.40 ***	0.05	0.38 ***	0.05
Female	-0.10	0.18	-0.33	0.24	-0.04	0.24	-0.24	0.19	-0.12	0.23	-0.28	0.24
Age	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01
Education	-0.02	0.06	-0.27 **	0.08	-0.19 *	0.08	-0.03	0.07	-0.17 *	0.08	-0.17 *	0.08
Conservatism[‡]	0.14	0.09	0.21	0.12	0.23	0.12	0.40 ***	0.09	0.49 ***	0.11	0.50 ***	0.11
R-squared	0.13		0.16		0.12		0.20		0.24		0.22	
F(df1, df2)	*7.89* (13, 678)		*9.97* (13, 678)		*7.20* (13, 678)		*13.67* (13, 691)		*16.90* (13, 691)		*15.11* (13, 691)	

Signif. codes: *p < 0.05, **p < 0.01, ***p < 0.001

[†]Positive Feelings Toward Facebook: continuous variable from strong negative feelings to strong positive feelings

[‡]Conservatism: continuous variable from very liberal to very conservative

Table 3. Regression analyses for climate change doubters and believers on perceived trustworthiness of, likelihood of "liking", and likelihood of "sharing" posts based on fake news.

REAL NEWS	DOUBTERS						BELIEVERS					
	TRUST		LIKE		SHARE		TRUST		LIKE		SHARE	
	B	Std. Err.	*B*	Std. Err.	*B*	Std. Err.	*B*	Std. Err.	*B*	Std. Err.	*B*	Std. Err.
Intercept (Control, NASA)	5.13 ***	0.56	6.75 ***	0.72	5.17 ***	0.73	6.40 ***	0.53	6.93 ***	0.73	7.39 ***	0.76
Guidelines	0.16	0.20	-0.06	0.26	0.08	0.26	0.62 **	0.18	0.39	0.25	0.23	0.26
Enhanced Guidelines	0.31	0.20	0.07	0.26	0.24	0.26	0.22	0.18	0.15	0.25	-0.14	0.27
USA Today	-0.82 *	0.38	-0.97 *	0.49	-0.67	0.49	0.79 *	0.39	0.85	0.54	0.81	0.57
Scientific American	-0.67 *	0.32	-1.43 ***	0.41	-1.20 **	0.41	-0.57	0.33	-0.65	0.45	-1.13 *	0.47
Recognize Source (NASA)	0.41	0.32	-0.69	0.42	-0.47	0.42	0.83 **	0.31	0.59	0.43	0.26	0.45
Recognize Source (USA Today)	0.68 *	0.31	-0.01	0.40	-0.01	0.41	-0.33	0.32	-0.38	0.44	-0.52	0.46
Recognize Source (Scientific American)	1.13 ***	0.32	0.58	0.41	0.83 *	0.42	0.95 **	0.27	1.12 **	0.38	1.07 **	0.39
Knowledge of Climate Change	0.17 ***	0.04	0.20 ***	0.05	0.20 ***	0.05	0.14 ***	0.04	0.07	0.05	0.09	0.05
Positive Feelings Toward Facebook[†]	0.26 ***	0.03	0.42 ***	0.04	0.40 ***	0.04	0.15 ***	0.03	0.34 ***	0.04	0.34 ***	0.05
Female	0.29	0.18	0.03	0.23	0.02	0.23	-0.23	0.16	-0.13	0.22	-0.62 **	0.23
Age	0.01	0.01	0.02 *	0.01	0.01	0.01	0.00	0.01	0.00	0.01	-0.01	0.01
Education	0.05	0.06	-0.25 **	0.08	-0.22 **	0.08	0.06	0.06	0.00	0.08	-0.07	0.08
Conservatism[‡]	-0.26 **	0.09	-0.47 ***	0.12	-0.16	0.12	-0.28 ***	0.07	-0.25 *	0.10	-0.20	0.10
R-squared	0.19		0.22		0.18		0.16		0.13		0.13	
F(df1, df2)	*12.12* (13, 666)		*14.55* (13, 666)		*10.97* (13, 666)		*9.56* (13, 659)		*7.34* (13, 659)		*7.89* (13, 659)	

Signif. codes: *p < 0.05, **p < 0.01, ***p < 0.001

[†]Positive Feelings Toward Facebook: continuous variable from strong negative feelings to strong positive feelings

[‡]Conservatism: continuous variable from very liberal to very conservative

Table 4. Regression analyses for climate change doubters and believers on perceived trustworthiness of, likelihood of "liking", and likelihood of "sharing" posts based on real news.